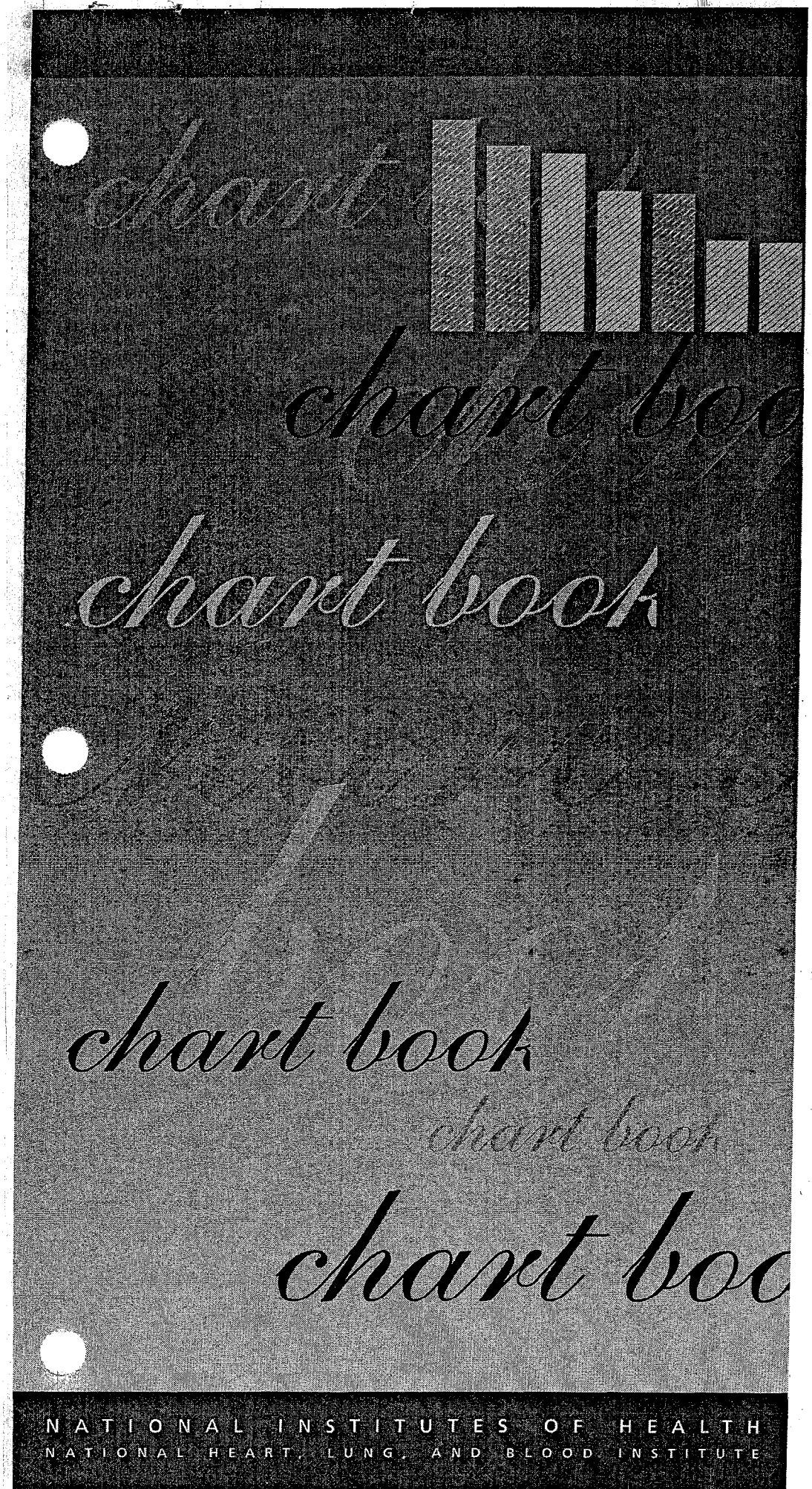

MORBIDITY & MORTALITY: 2000 CHART BOOK ON CARDIOVASCULAR, LUNG, AND BLOOD DISEASES

NATIONAL INSTITUTES OF HEALTH
NATIONAL HEART, LUNG, AND BLOOD INSTITUTE

Foreword

The mission of the National Heart, Lung, and Blood Institute (NHLBI) is to provide leadership and support for research in cardiovascular, lung, and blood diseases; sleep disorders; women's health; and blood resources. The ultimate goal is to improve the health and well-being of the American people. While program priorities are determined primarily by research opportunities, other factors have an influence: the magnitude, distribution, and trends of these diseases in the United States, as well as the ability to improve the Nation's health. In addition, congressional mandates and the health needs of the country as perceived by Institute staff or outside advisory groups, and recommendations from the National Heart, Lung, and Blood Advisory Council, all have a significant impact on establishing research priorities.

Evaluation of the Institute's program balance and program impact is a continuous process that relies on assessments of morbidity and mortality in the United States from heart, lung, and blood diseases. Consideration is given to their distribution among the population; to their trends over time; and to related statistics on population risk factors, lifestyles, medical care, and economic impact.

This Chart Book, like its predecessors, is a resource that provides information for a limited set of common cardiovascular, lung, and blood diseases. Charts with age-adjusted death rates are based on the age distribution of the projected population for the year 2000. The new standard, which replaces the 1940 standard, was approved by the Department of Health and Human Services for official, nationwide implementation beginning with the 1999 mortality statistics. Since the change has a significant impact on mortality statistics, the NHLBI decided to apply the new standard in this Chart Book. For continuity, the same charts, but adjusted to the traditional 1940 standard, are also presented.

I would like to express my appreciation to Mr. Thomas Thom of the NHLBI for his time and effort in developing the material presented in this Chart Book.

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1. Introduction

During the past 30 years, major advances have been made in the prevention, diagnosis, and treatment of cardiovascular, lung, and blood diseases. Death rates from cardiovascular diseases (CVD) have declined significantly, and the American people are living longer, healthier lives. Yet, despite the tremendous progress that has been made, morbidity and mortality from cardiovascular, lung, and blood diseases continue to contribute to the immense burden experienced by many individuals and their families, and the economic cost to the Nation is substantial.

This Chart Book describes the magnitude of the problem and time trends of these diseases, highlighting demographic differences—age, sex, and minority/ethnic status. Morbidity and mortality statistics are given for cardiovascular, lung, and blood diseases in the United States as well as for states and selected countries.

The Background Data chapter provides population and life-expectancy estimates, trends in total mortality, and statistics that show leading causes of morbidity and mortality, economic costs of disease, and prevalence of CVD risk factors. The Cardiovascular Diseases, Lung Diseases, and Blood Diseases chapters contain morbidity and mortality statistics on diseases listed in the Contents. Diseases included under the three headings are listed in the first table in each chapter together with appropriate diagnostic codes of the ninth revision of the *International Classification of Diseases* (ICD).

The age-adjustment standard—age distribution of the population in 2000—is used for the age-adjusted charts in Chapters 2 through 5 of this book. Charts with rates age-adjusted to the old 1940 standard appear in Chapter 6 for comparison. A discussion of the reasons for the new standard and its impact on the calculation of mortality levels, demographic comparisons, and trends may be found in Chapter 6 of the 1998 Chart Book.

Sources of Data

Most of the statistical information used in this book was obtained from the National Center for Health Statistics (NCHS): specifically, the annual vital statistics of the United States; the annual National Health Interview Survey (NHIS); the National Health and Nutrition Examination Survey (NHANES), 1971-1975, 1976-1980, and 1988-1994; the annual National Hospital Discharge Survey; and the annual National Ambulatory Medical Care Survey. International mortality data came from the *World Health Statistics Annual* of the World Health Organization (WHO) and the WHO website.

It is beyond the scope of the Chart Book to list and cite all of the NCHS, WHO, and Bureau of the Census publications and data tapes that were used to prepare this document. Specific data sources for current statistics and general references to hospital and prevalence surveys and vital statistics for earlier data years may be found in the Reference section.

Population Estimates

Annual population estimates are used by the NCHS and the NHLBI to calculate death rates. For the census enumeration years (e.g., 1950, 1960), the estimates express the population count as of April 1; for the intervening years they indicate the population estimate as of July 1. Death rates before 1961 were obtained directly from NCHS vital statistics publications. Rates for 1961-1969 and 1981-1989 were calculated by the NCHS or the NHLBI using population estimates from the Bureau of the Census that were revised after the published rates appeared in the volumes of vital statistics. Thus, the calculated rates differ from the published vital statistics. From 1968-1997, the NCHS and the NHLBI used data from public use mortality tapes and U.S. Bureau of the Census population estimates to calculate mortality rates.[1-6] The 1998 estimates

could only be provided by personal communication with the NCHS; the mortality statistics for that year are considered preliminary.

International Classification of Diseases

The diagnostic terminology used in this book is similar to the one found in the ninth revision of the ICD (ICD/9).[7] Appendix A consists of tables with this terminology and the 1 through 9 ICD revisions codes for selected diagnostic categories.

Quality of Data

Information from national sample surveys is used to determine disease and risk factor prevalence. The surveys consist of a heath interview in which the respondents provide self-reporting data reflecting a doctor's diagnosis of their disease and a physical examination in which the blood pressure, blood cholesterol levels, and weight of participants are measured and smoking habits are documented. Physician office visit data are derived from information provided in physician questionnaires and are based on the diagnostic information recorded in patient medical records. No estimates are provided for prevalence, hospitalizations, or physician office visits if the relative standard error is 30 percent or greater. The major limitation of these surveys is the quality of the diagnostic information.

Hospital Statistics

Hospitalization rates are a useful measure of health care utilization. National hospitalization and hospital case-fatality statistics, however, have limitations associated with diagnostic accuracy and diagnostic comparability over time (e.g., the diagnosis may be influenced by the billing process). Moreover, time trends may not accurately reflect real changes in incidence and case-fatality because the data occasionally include changes in hospital admission practices. Nevertheless, diagnoses obtained from hospital records are accepted as reported.

The term "hospitalizations," which replaces the National Hospital Discharge Survey term "hospital discharges," refers to all patients, whether discharged alive or dead. The diagnosis given at discharge, and not at admission, is used. Most tabulations of hospitalizations are for first-listed diagnoses on the hospital record, i.e., primary diagnosis. Some tabulations are of the "all-listed" diagnoses that include both primary and secondary diagnoses for a particular disease. The National Hospital Discharge Survey is event-based rather than patient-based and does not distinguish between patients who were hospitalized multiple times for the same diagnosis and patients who were hospitalized only once in a given year. Each hospitalization is treated as a discrete event and is counted accordingly.

Cause-of-Death Statistics

Limitations of cause-of-death statistics, apart from discontinuities over time caused by revisions in the ICD, are well known. Less well known is the break in continuity in 1989 caused by the insertion of cause-of-death instructions on the back of death certificates. Inaccuracies in death certification and inconsistencies in selecting and coding the underlying cause of death create uncertainties as to the true magnitude of mortality from a specific cause compared with other causes. These uncertainties also must be kept in mind when comparing the same cause of death over time or the same cause of death between demographic groups or countries. Selecting only one cause of death as the underlying cause has the advantage of diagnostic specificity, but the disadvantage of an incomplete accounting of the various causes that contributed to the death. Because of the complexity of basing mortality statistics on tabulations of both the underlying (primary) and contributing (secondary) causes of death, most data are for the underlying causes.

Another limitation related to cause-of-death statistics concerns cross-national comparisons of vital statistics. Comparisons of mortality data for

coronary heart disease (CHD), stroke, and chronic obstructive pulmonary disease (COPD) among countries are affected by differences in diagnostic practices and physician training, interpretation of internationally recommended rules for coding a cause of death, availability of diagnostic aids, and the use of autopsies. Information presented in this book is limited to countries that are known to produce high-quality statistics.

ICD Revisions

Revisions in the ICD have affected the comparability of time trends for some diagnoses, particularly those associated with mortality. Because discontinuity across recent ICD revisions is especially large for CHD from 1968 to 1978, a comparability ratio—0.8784 based on the ICDA/8 to ICD/9 revisions—was applied to CHD age-adjusted death rates for this period.[8] As a result, comparability for total CHD mortality is assumed to be reasonably good during the 1950-1998 period. However, this assumption is not made for age-, race-, or sex-specific mortality. Breaks between revisions are shown on many of the time-trend figures in which comparability is a concern. Coding rules and practices are not universal, so differences that affect comparability of cause-specific morbidity and mortality exist in diagnosis coding by countries, states, and demographic groups.

Data Presentation

Special attention is directed to certain issues involving data presentation in the Chart Book. The following information addresses these topics.

Age-Adjustment of Rates

Direct age adjustment of U.S. death rates follows the procedure used by the NCHS, but with a new age-adjustment standard, the 2000 U.S. population in 10-year age groups.[9-10] This standard is also used to summarize the age-specific prevalence for diseases and risk factors based on the NHANES data. The European standard population, however, is used for age adjustment for international mortality statistics.[11]

Chapter 6 includes charts based on the 1940 standard. Officially, this standard will continue to be used to report vital statistics through the 1998 data year. Because of the relatively young population in 1940, rates are lower than those obtained with the new standard. Regardless of the standard used, the major advantage of age adjustment is to remove the effects of age distribution differences when comparing mortality over time or by sex, race, ethnicity, or geographic location.[12]

The major disadvantage of using age-adjusted rates is loss of age-specific information. This becomes evident when the population groups being compared have mortality differences that are not in the same direction over a given age range. For example, the bar chart (Chart 3-28) for heart disease mortality has higher age-adjusted rates for whites than for blacks, but the line chart (Chart 3-29) by age shows higher rates for whites only at the oldest ages.

Percent Change

Percent changes in death rates over time, whether between two years or on an average annual basis, are calculated from log-linear regression slopes of rates for each year of a selected time period.[13] They may be influenced by unusually high or low values, especially if the period is short. They do not provide information about the levels on which they are based, which might be small. Average annual percent changes should not be summed over a period because the sum will be more than the percent change from the first to the last year in the period. Average annual percent changes give the appearance of small differences in the comparisons being made. An exception to the use of log-linear regression to calculate percent change is made for Chart 3-6 and Chart 3-6 (1940). For these tables, it is useful to have the percent change and other calculations based on the actual death rates.

Horizontal and Vertical Scales

Comparisons between time-trend charts are complicated because ranges of the horizontal and vertical scales are not uniform and may be truncated. Vertical scales for less common diagnoses are magnified to focus on age, race, and sex differences.

Arithmetic and Logarithmic Scales

Death rates in most time-trend graphs in the first Chart Book (prepared in 1990) were plotted on a logarithmic Y-scale to reflect their relative (or percent) change over time. In the current Chart Book, time trends in death rates were plotted on an arithmetic Y-scale to show their absolute change relative to zero. Note, however, that on an arithmetic scale, the absolute increase or decrease for a smaller death rate might be modest compared with the change for a larger death rate, but the percent change over time can be greater for the smaller rate. Note also that on an arithmetic scale, a decline can be slowing, whereas the rate of decline, if plotted on a logarithmic scale, might not be slowing. Where particularly appropriate, these differences are discussed in the chart text.

Truncated Age Ranges

The age range for death rates in some charts excludes groups older than 84 years because of the difficulty associated with obtaining accurate diagnoses for these patients who often have other contributing comorbidities. Selected truncated age groups are frequently used for U.S. data to highlight specific premature adult morbidity and mortality. For international comparisons, the age range 35-74 was chosen so that differing age distributions among countries would be minimized in rate calculations.

Diagnostic Categories

Selection of diagnostic groups to present depends on data availability, data quality, and influences of the ICD revisions. Additional information related to diagnostic categories may be found in Chapters 3, 4, and 5.

Demographic Characteristics

The Chart Book provides prevalence and mortality information for various racial and ethnic groups. Several charts show comparisons between blacks and whites, but others, notably when showing time trends, present data for nonwhites instead of data for blacks. While many charts provide a race/sex comparison, others present data for total males and total females or for total whites and total blacks to highlight important points that otherwise would be lost if a four-way combination were used.

The term "American Indian" is used to refer to the population that consists of American Indians and Alaska Natives. The term "Asian" is used to include the population that consists of Asians and Pacific Islanders. Data on socioeconomic groups are not presented because they are extensively presented elsewhere.[14]

State Mortality

Death rates for total population by state are shown for CVD, CHD, stroke, and COPD.[15] Although state maps that combine all age, race, and sex groups can be misleading, the included maps show a reasonably similar geographic pattern compared with maps that are either race and sex specific or confined to a specific age range (not shown). This situation is true even for stroke mortality, in which high rates in southern states are not due merely to the large black population. Although rankings of certain states for CHD mortality differ markedly from rankings for total heart disease, the two geographic patterns are not much different.[16]

Time Periods

Time-trend statistics are current and extend as far back as permitted by the availability of comparable data. The focus in some charts is on the year 1963. After application of a comparability ratio to age-adjusted death rates for 1968 to 1978 for CHD, 1963 was determined to be the peak year before the decline began.

2. Background Data

The tables and figures in this chapter provide population estimates, life expectancy, morbidity and mortality information, and economic cost data for cardiovascular, lung, and blood diseases. Most of the charts focus on the leading causes of death, but a few show prevalence of specific CVD risk factors.

Prevalence, incidence, and mortality estimates for selected cardiovascular, lung, and blood diseases, derived from various data sources, are presented in the next few paragraphs with minimal explanation of their definition, source, or quality. Except as referenced, they should be attributed only to the NHLBI.

Cardiovascular diseases. An estimated 59.7 million Americans have CVD—50 million of them, about one-fourth of the adult population, have hypertension.*[17-19] The prevalence of CHD is approximately 12.2 million—7.2 million have acute myocardial infarction (AMI) and 6.3 million have angina pectoris as determined from the Rose Angina Questionnaire. Persons with unrecognized CHD are not included. According to the same source, an estimated 4.4 million Americans have stroke, 4.6 million have congestive heart failure (CHF), and 1 million have congenital heart defects. The prevalence of atrial fibrillation is 2 million.

Approximately 1.1 million—650,000 first and 450,000 recurrent—heart attacks occur each year in the United States, with about 450,000 resulting in death.[6, 20-21] The term "heart attack" includes overt AMI and CHD death. Angina pectoris, not complicated by an AMI, is not included. In 1996, an estimated 225,000 people died of CHD without being hospitalized.[22]

An estimated 600,000—500,000 first and 100,000 recurrent—strokes occur each year in the United States, and almost 160,000 result in death.[12, 23] An estimated 550,000 new cases of heart failure occur each year.[24] Congenital heart disease is estimated to occur in one of every eight live births, resulting in about 32,000 new cases each year.

Lung diseases. Fifteen million Americans are estimated to have COPD—14.1 million of them have chronic bronchitis, 1.8 million have emphysema, and almost a million have both conditions.[25] The prevalence of asthma is approximately 14.6 million. Other chronic lung diseases include cystic fibrosis, which affects an estimated 30,000 Americans, with incidence estimated to be 2,500 births each year; and respiratory distress syndrome, which occurs in 40,000 babies and 150,000 adults each year.

Blood diseases. An estimated 3.5 million Americans have some form of anemia.[25] An estimated 72,000 blacks—1 of 500 black births—have sickle cell anemia, 20,000 persons have hemophilia, and 1,000 persons have Cooley's anemia.

* The definition of hypertension is systolic blood pressure of 140+ mmHg or diastolic pressure of 90+ mmHg or on antihypertensive medication. The estimate is an extrapolation to the 1991 U.S. population of unpublished prevalence rates from the NCHS's NHANES, 1988-1991.

3. Cardiovascular Diseases

In this chapter, the diagnostic group *cardiovascular diseases* (CVD) is used to mean diseases of the circulatory system as coded in the ICD. Charts show morbidity and mortality data for total heart disease, coronary heart disease (CHD), congestive heart failure (CHF), cardiomyopathy, atrial fibrillation, hypertension, cerebrovascular diseases, and diseases of arteries. Congenital anomalies of the circulatory system have also been included here even though this term is found in a separate chapter of the ICD.

Chart 3-4 contains a list of selected CVD along with the ninth revision ICD codes. It also includes 1997 estimates of hospital discharges, durations of stay, physician office visits, and deaths for these diagnostic categories. The terminology used is modified from the exact ICD terminology listed in Appendix A. Subsequent graphs and tables display morbidity and mortality for most of the following CVD.

Forty-eight percent of all CVD deaths in 1998 were due to CHD, 16.7 percent to stroke, and 4.5 percent to other diseases of the arteries (Chart 3-1). Thus, about 70 percent of all CVD deaths were atherosclerotic-related.

Heart Disease

Many forms of heart disease exist; as a disease category, "heart disease" is the number one cause of death and a common cause of morbidity. Mortality and morbidity statistics are provided to show trends among specific groups (racial/ethnic, sex) and by geographic location. Because heart disease includes hypertensive and rheumatic heart diseases, both of which have long been declining as causes of death, the rise in mortality from total heart disease in the 1940s and 1950s was modest compared with the significant increase for its major component, CHD.

Coronary Heart Disease

CHD accounts for almost two-thirds of all heart disease deaths (Chart 3-2). However, identifying CHD as the underlying cause of death is sometimes difficult because the diagnostic information available at the time of death can be insufficient to distinguish accurately among the numerous forms of heart disease. In addition, over the years, multiple revisions of the ICD have led to changes in the codes for the various forms of heart disease. As a result, discontinuities in trends exist in mortality data (Chart 3-24) that compare CHD death rates among racial/ethnic and sex groups.

The "AMI" classification is a useful category for hospitalization and physician office visit statistics and for prevalence, but less so for mortality. Because the subgroup "angina pectoris" is a notoriously poor diagnostic category in standard morbidity and mortality statistics, its presentation here is limited.

Congestive Heart Failure

CHF is a sequela of various heart diseases. It is a heart "condition," not a heart "disease," and is more common as a contributing rather than an underlying cause of death. Thus, it is not precise to classify CHF as an underlying cause of death. The condition, however, is increasingly prevalent and common in hospitalizations and mortality reporting. It is marked by an extraordinarily poor prognosis. Hospitalization and mortality for CHF have increased (until very recently), while mortality for total heart diseases has declined.

Cardiomyopathy

In 1997, more than 28,000 deaths were attributed to cardiomyopathy even though no consensus exists on classification and diagnostic criteria for the disease. It is assumed that this limitation has little effect on any mortality differences influenced by age, race, or sex.

Atrial Fibrillation and Other Heart Diseases

The number of patients hospitalized with atrial fibrillation has been increasing, but the number of deaths attributed to this disorder is not known

because the diagnostic information on the death certificate is inadequate. Diseases of pulmonary circulation, acute and subacute endocarditis, and cardiac dysrhythmias are a few of the other heart diseases of interest, but measures of their morbidity, and especially their mortality, are of uncertain quality. Therefore, no charts pertaining to them have been included.

Hypertensive Disease

Prevalence and trend data on awareness, treatment, and control of hypertension are important statistics associated with hypertension morbidity. Mortality statistics are not presented for hypertensive disease because it is not a distinct underlying cause of death. In fact, its presence on death certificates is often arbitrary, and its selection as the underlying cause of death is often characterized by a lack of good diagnostic information at the time of death. However, where death rates for hypertensive disease have been presented, the trends have been markedly downward.

Cerebrovascular Diseases (Stroke)

Cerebrovascular disease, i.e., stroke, is the third leading cause of death. Only a small proportion of deaths from stroke can be classified as cerebral hemorrhage, occlusion, thrombosis, or embolism. Most are coded to ill-defined forms of cerebrovascular disease (Chart 3-3). Thus, mortality for the entire category is presented.

Diseases of Arteries

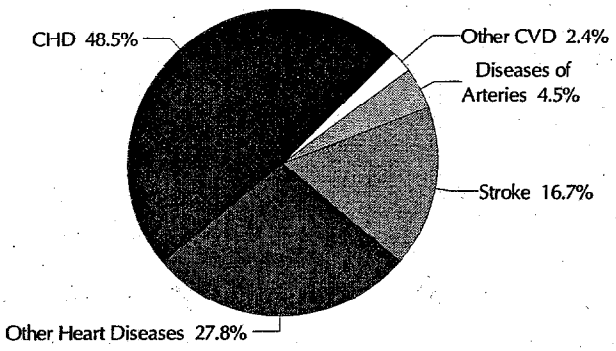
The ICD term "diseases of arteries" is used to refer to peripheral vascular disease and includes a variety of atherosclerotic disorders; none of them specifically involves the heart or brain. Examples are aortic aneurysm, atherosclerosis of the extremities, arterial embolism and thrombosis, and generalized atherosclerosis. Hospital, physician visit, and mortality data are presented, but valid prevalence estimates are not available.

Congenital Anomalies of the Circulatory System

The ICD term "congenital anomalies of the circulatory system" includes congenital heart disease. Because most deaths in this disease category occur in infants younger than 1 year of age, the preferred mortality tabulation is the infant mortality rate.

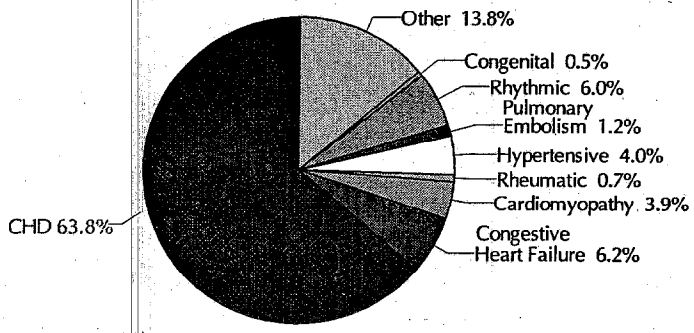
Cardiovascular Diseases

Chart 3-1
Cardiovascular Disease Deaths, Percent* by Subgroup, U.S., 1998



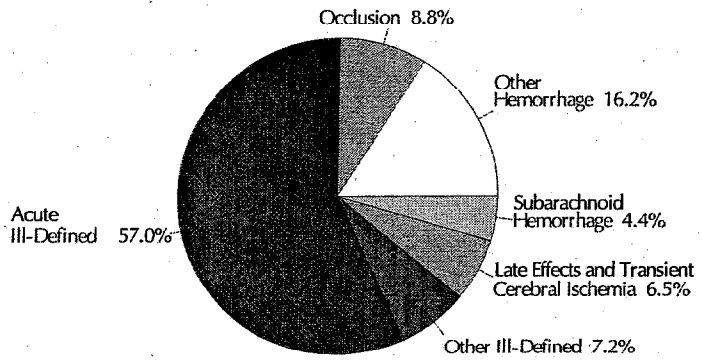
Total Deaths = 948,572 (100%), including congenital cardiovascular disease, ICD/9 codes 745–747.

Chart 3-2
Heart Disease Deaths, Percent* by Subgroup, U.S., 1997



Total Deaths = 730,674 (100%), including 3,700 from congenital heart disease, ICD/9 codes 745-746.

Chart 3-3
Stroke Deaths, Percent* by Subgroup, U.S., 1997



Total Deaths = 159,791 (100%)

* Numbers may not add to 100% due to rounding.

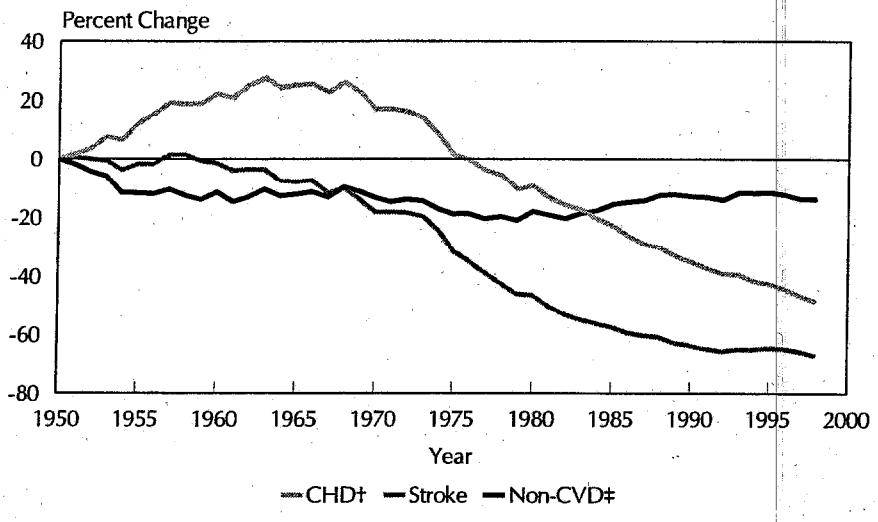
Cardiovascular Diseases

Chart 3-4
Number of Hospitalizations, Physician Office Visits, and Deaths for Cardiovascular Diseases, U.S., 1997

Diagnostic Category	ICD/9 Codes	Hospitalizations First-Listed Discharge (000)	Hospitalizations Length of Stay (Days)	Physician Office Visits (000)	Deaths
Total CVD	390-459, 745-747	6,145	5.3	60,442	953,110
Heart disease	390-398, 402, 404-429	4,188	5.1	19,632	726,974
Rheumatic heart disease	390-398	35	7.3	270	5,014
Hypertensive heart disease	402, 404	126	5.2	726	29,031
Coronary heart disease	410-414	2,090	4.8	10,678	466,101
Acute myocardial infarction	410	756	6.0	261	206,212
Angina pectoris	413	97	2.5	1,083	735
Other CHD	411, 412, 414	1,237	4.2	9,333	259,154
Diseases of pulmonary circulation	415-417	87	6.6	104	12,002
Pulmonary embolism	415.1	71	6.9	90	8,596
Other	415.0, 416-417	16	5.4	34	3,406
Acute and subacute endocarditis	421	17	11.8	18	981
Cardiomyopathy	425	39	6.7	651	28,190
Congestive heart failure	428.0	957	5.8	2,763	45,419
Atrial fibrillation	427.31	319	4.5	1,215	6,486
Other arrhythmias	426, 427 (except 427.31)	378	4.1	1,788	38,503
Other heart diseases	420, 422-424, 428.1, 428.9, 429	140	5.8	1,419	95,257
Other hypertensive diseases	401, 403	296	4.2	29,958	13,534
Cerebrovascular diseases	430-438	1,018	5.8	1,684	159,791
Diseases of arteries	440-448	304	7.2	2,640	43,849
Atherosclerosis	440	114	7.3	110	16,057
Aortic aneurysm	441	71	8.6	213	16,724
Other diseases of arteries	442-448	119	6.3	2,317	11,068
Diseases of veins	451-459	285	5.6	6,015	4,264
Deep vein thrombosis	451.1	22	6.4	0	681
Other diseases of veins	451.0, 451.2-459	263	5.5	6,015	3,583
Congenital anomalies of the circulatory system	745-747	48	7.8	244	4,698
Congenital heart disease	745-746	35	8.0	187	3,700
Other congenital anomalies of the circulatory system	747	13	7.4	57	998

Note: Estimates of hospitalizations and physician office visits are subject to sampling variability. Estimates of hospitalizations below 50,000 have a relative standard error of more than 11 percent. Estimates of physician office visits below 588,000 have a relative standard error of more than 30 percent.
Compiled from references 15, 34-35.

Chart 3-5
Change in Age-Adjusted Death Rates* Since 1950, U.S., 1950-1998



* Age-adjusted to the 2000 standard.
† Comparability ratio applied to rates for years 1968-1978.
‡ Total mortality minus CVD (excluding congenital).

The CHD death rate increased 27% from its level in 1950 to a peak in 1963. By 1998, it was 49% lower than in 1950. The rate for stroke declined in most years so that by 1998 it was 67% lower than in 1950. The death rate for the non-cardiovascular causes of death was only 14% lower in 1998 than in 1950.[15, 22, 29]

Chart 3-6
Age-Adjusted Death Rates* and Percent Change for All Causes and Cardiovascular Diseases, U.S., 1963 and 1998

Cause of Death	Deaths/100,000 Pop. 1963	1998	1963-1998 Difference	Percent Change	% Contribution to Total Decline
All causes	1346.3	876.2	-470.1	-34.9	100
CVD†	805.4	354.9	-450.5	-55.9	96
CHD	429.1	173.0	-256.1	-59.7	54
Stroke	173.9	59.5	-114.4	-65.8	24
Other CVD	202.4	122.4	-80.0	-39.5	17
Non-CVD	540.9	521.3	-19.6	-19.6	4

* Age-adjusted to the 2000 standard.
† Excludes congenital anomalies of the circulatory system.

Between 1963 and 1998, the CVD death rate declined 56% compared with 20% for all non-CVD causes of death. Ninety-six percent of the total mortality decrease was due to the decline in CVD. CHD and stroke mortality declined 60% and 66%, respectively.[15, 22, 29]

Chart 3-7
Average Annual Percent Change in Age-Adjusted Death Rates* for All Causes and Cardiovascular Diseases, U.S., 1965-1998

Period	All Causes	Total CVD†	CHD‡	Stroke	Other CVD	All Other Causes
1965-1970	-1.1	-1.9	-1.1	-2.2	-3.4	-0.1
1970-1975	-2.0	-2.7	-2.7	-3.2	-2.2	-1.2
1975-1980	-1.4	-2.4	-2.5	-5.2	-0.1	-0.1
1980-1985	-0.9	-2.4	-3.0	-4.4	+0.1	+0.6
1985-1990	-1.0	-2.9	-3.4	-3.0	-2.2	+0.8
1990-1995	-0.3	-1.3	-2.3	-0.3	-0.1	+0.5
1995-1998	-1.6	-2.6	-3.6	-2.3	-1.2	-0.9

* Age-adjusted to the 2000 standard.
† Excludes congenital anomalies of the circulatory system.
‡ Comparability ratio applied to rates for 1968-1978.

Declines in CVD mortality continue. Average annual percent declines between 1995 and 1998 are 2.6% for CVD, 3.6% for CHD, and 2.3% for stroke.[15, 22, 29]

Chart 3-8
Average Annual Percent Change in Age-Adjusted Death Rates* for All Causes and Cardiovascular Diseases by Race and Sex, U.S., 1990-1998

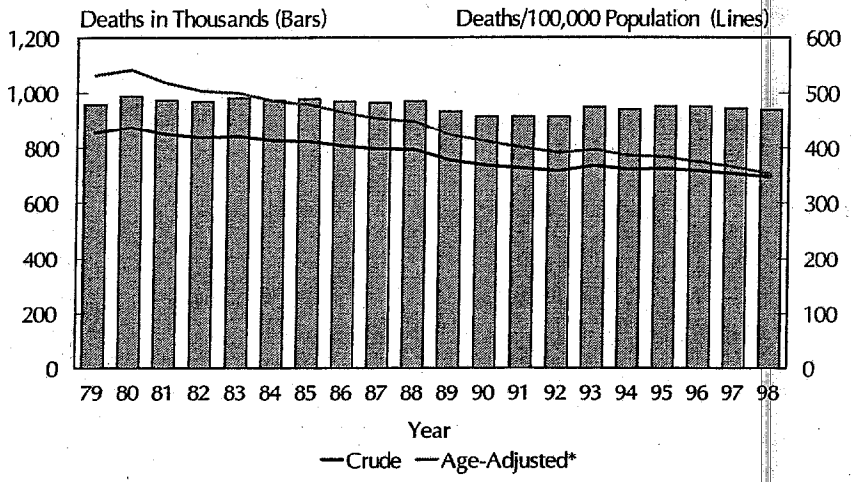
	Total	White Male	White Female	Black Male	Black Female
All causes	-0.7	-1.3	0.0	-1.9	-0.5
CVD†	-1.7	-2.2	-1.3	-2.1	-1.4
Heart disease	-1.9	-2.4	-1.6	-2.4	-1.9
Coronary	-2.7	-3.1	-2.5	-2.7	-1.9
CHF†	+1.8	+1.6	+2.3	-0.6	+0.4
Stroke	-0.7	-1.0	-0.3	-2.0	-1.1
All non-CVD†	0.0	-0.6	+0.9	-1.8	+0.1

* Age-adjusted to the 2000 standard.
† 1990-1997.

Between 1990 and 1998, declines in CVD, CHD, and stroke mortality were greater in males than in females. For CHD, they were greater in whites than in blacks. For stroke, they were greater in blacks than in whites. Declines were greater for CHD than for stroke.[15, 22, 29]

Cardiovascular Diseases

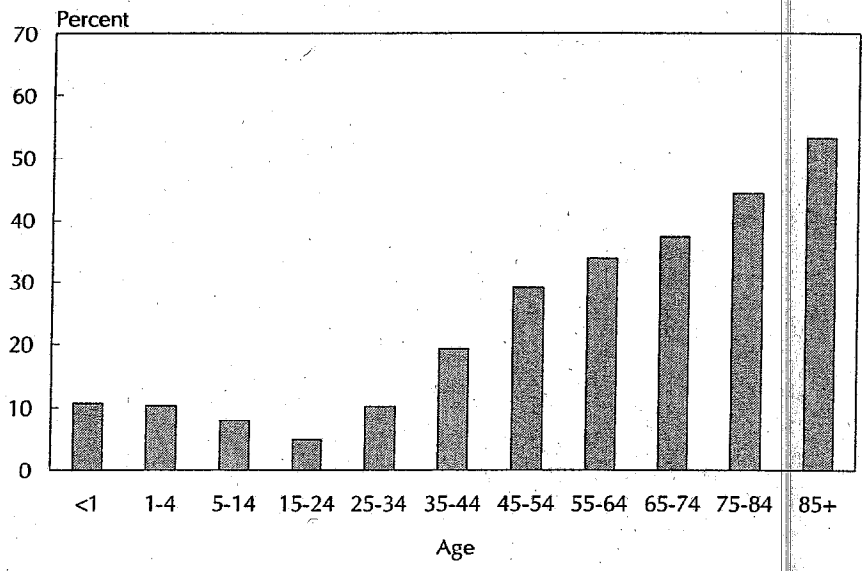
Chart 3-9
Deaths and Death Rates for Major Cardiovascular Diseases, U.S., 1979-1998



CVD death rates, crude and adjusted, declined considerably between 1979 and 1998, despite only a very modest decline in the total number of CVD deaths.[15, 22, 29]

* Age-adjusted to the 2000 standard.
Note: ICD codes 390-448. Total CVD would include about 10,000 more deaths.

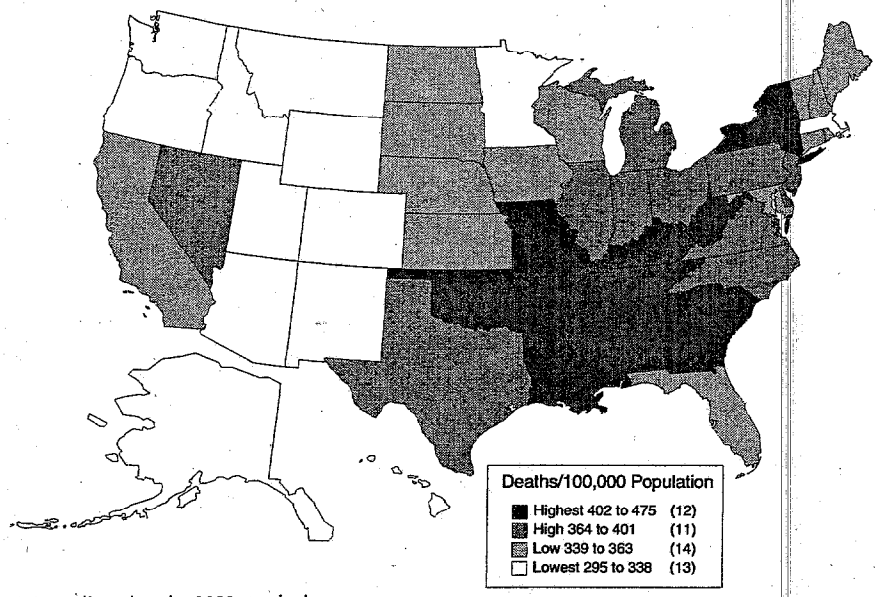
Chart 3-10
Percent of All Deaths Due to Cardiovascular Diseases by Age, U.S., 1998



The percentage of all deaths due to CVD increases with age among adults. It is 19% at age 35-44 and 53% at age 85+.[15, 22, 29]

Cardiovascular Diseases

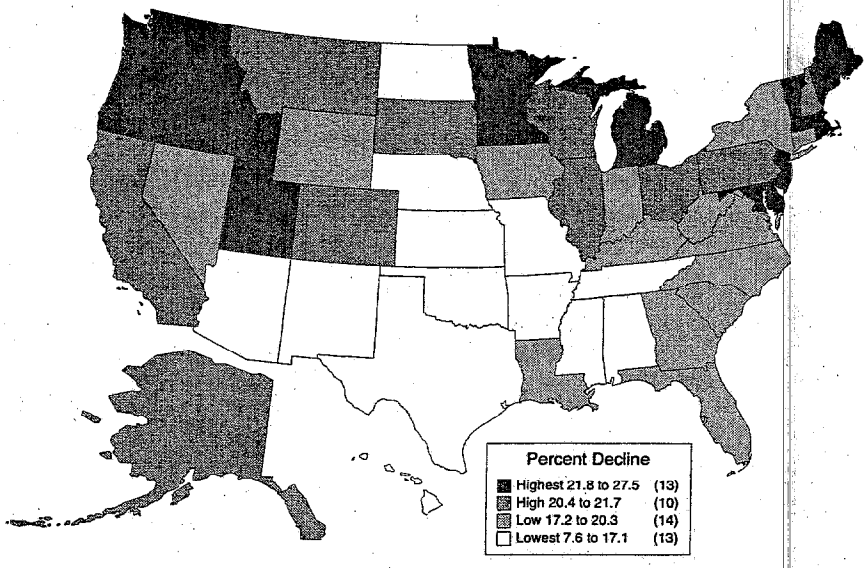
Chart 3-11
Age-Adjusted Death Rates* for Cardiovascular Diseases by State, U.S., 1995-1997



* Age-adjusted to the 2000 standard.

Highest CVD death rates tend to be in the East and the lowest in the West.[15]

Chart 3-12
Percent Decline in Age-Adjusted Death Rates* for Cardiovascular Diseases by State, U.S., 1985-87 to 1995-97

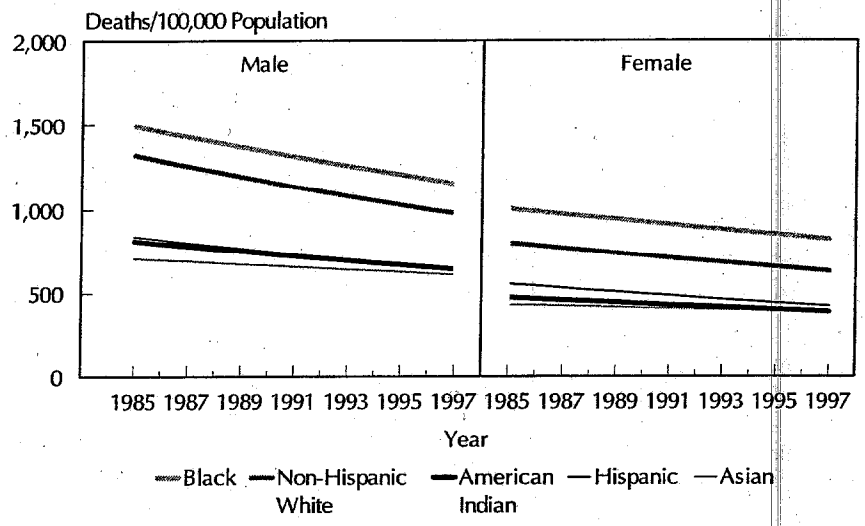


* Age-adjusted to the 2000 standard.

Between 1985-87 and 1995-97, the smallest average annual percent declines in CVD death rates tended to be in the South.[15]

Total Heart Disease

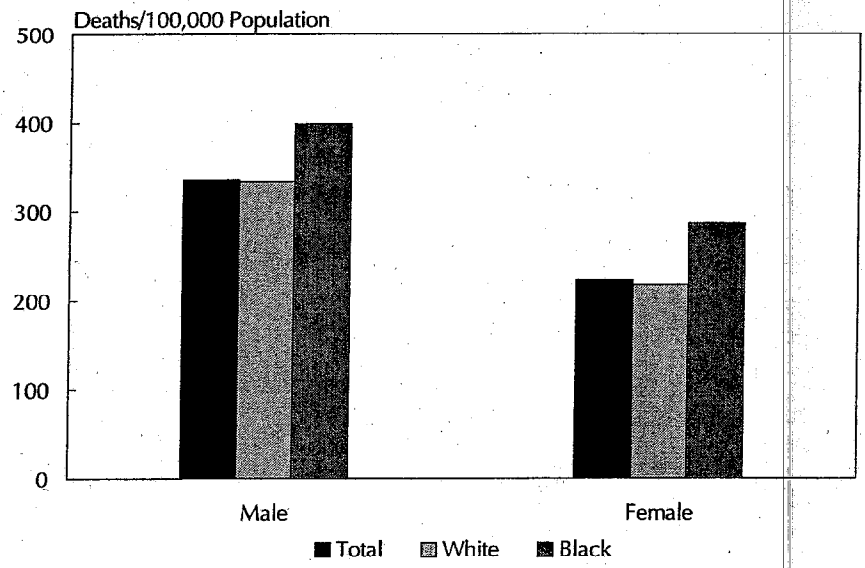
Chart 3-13
Age-Adjusted Death Rates* for Heart Disease by Race/Ethnicity and Sex, Age 45+, U.S., 1985-1997



* Age-adjusted to the 2000 standard.
Note: Each line is a log linear regression derived from the actual rates.

Between 1985 and 1997, heart disease death rates for males and females, age 45+, declined in blacks, whites, American Indians, and Hispanics. It declined much less in Asians.[12]

Chart 3-14
Age-Adjusted Death Rates* for Heart Disease by Race and Sex, U.S., 1998

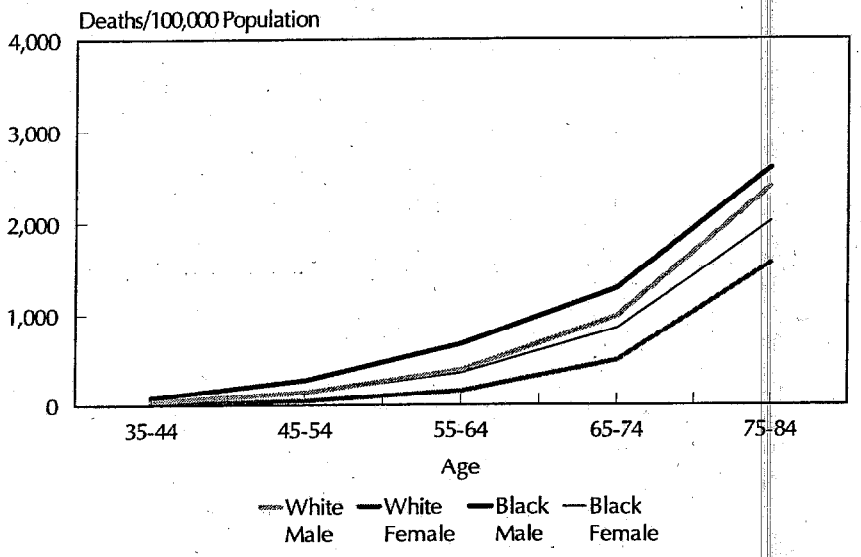


* Age-adjusted to the 2000 standard.

Heart disease mortality is 20% higher in black males than in white males, 31% higher in black females than in white females, and 50% higher in males than in females.[29]

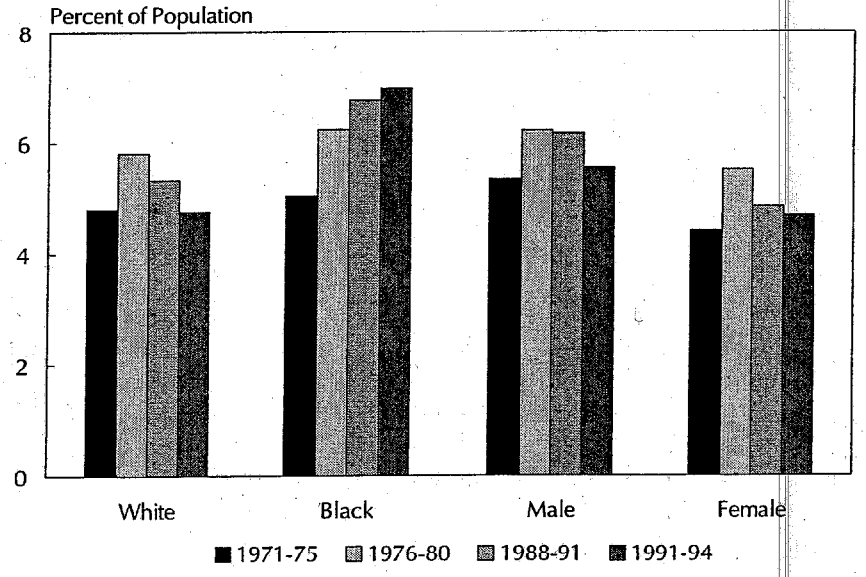
Total Heart Disease

Chart 3-15
Death Rates for Heart Disease by Age, Race, and Sex, U.S., 1998



Heart disease death rates are higher in black males than in white males and in black females than in white females at all ages from 35 to 84.[29]

Chart 3-16
Prevalence* of Coronary Heart Disease by Race and Sex, Age 25-74, U.S., 1971-75 to 1991-94

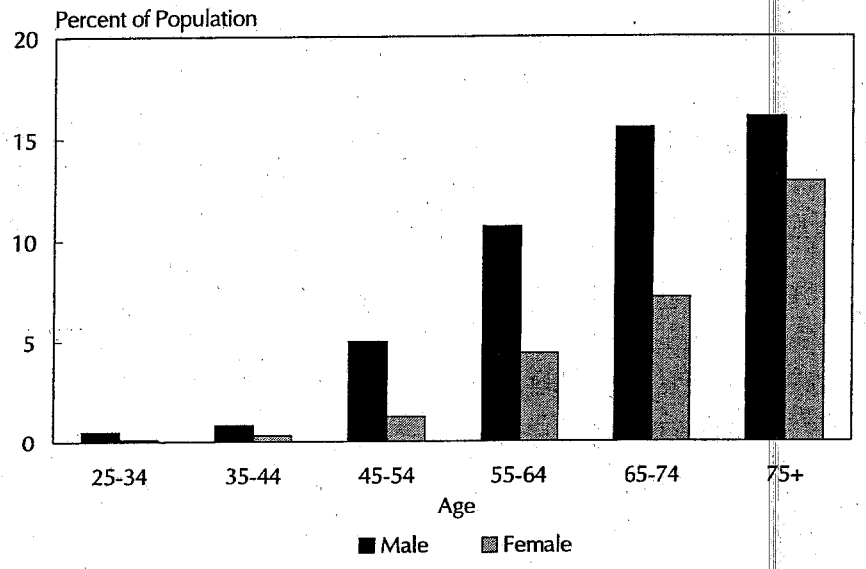


* Age-adjusted to the 2000 standard.

The prevalence of CHD increased in blacks between 1971-75 and 1991-94 and decreased in males, females, and whites between 1976-80 and 1991-94.[18]

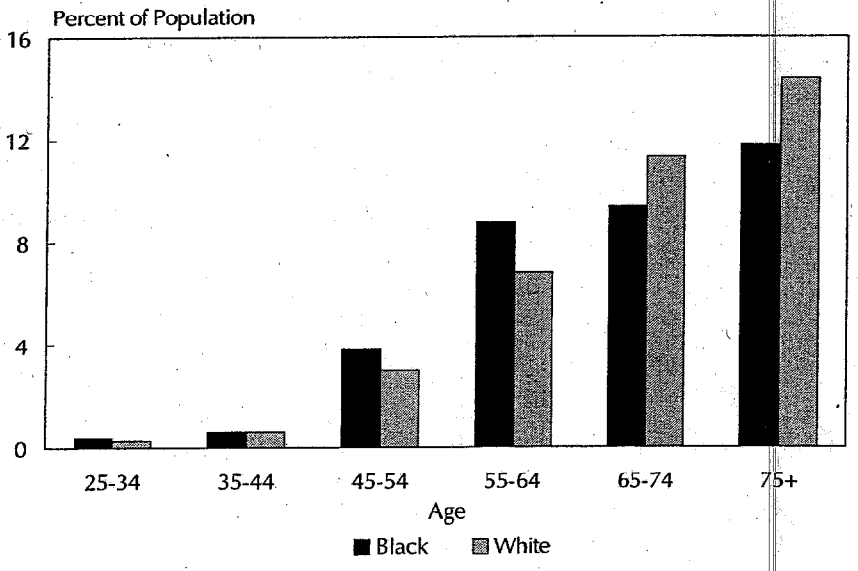
Coronary Heart Disease

Chart 3-17
Prevalence of Acute Myocardial Infarction by Age and Sex, U.S., 1988-1994



The prevalence of AMI is higher in males than in females at all ages.[18]

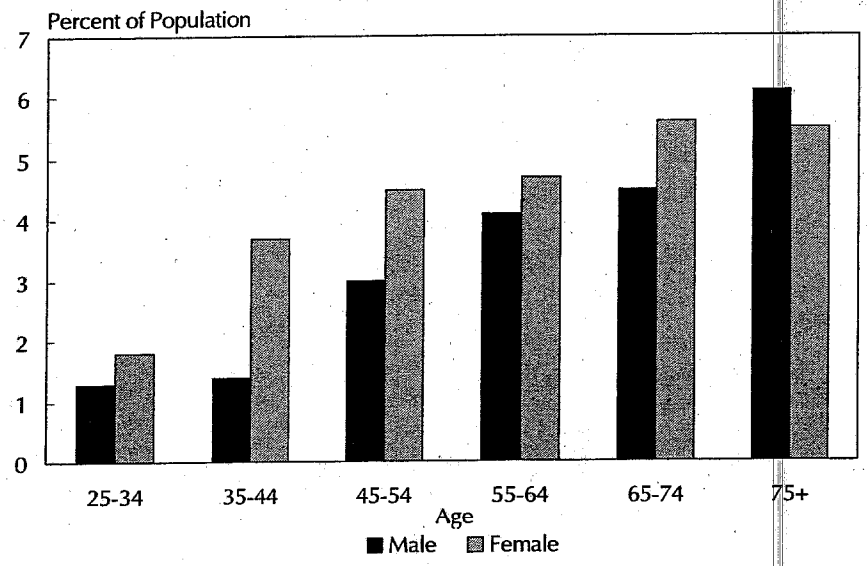
Chart 3-18
Prevalence of Acute Myocardial Infarction by Age and Race, U.S., 1988-1994



The prevalence of AMI is greater in blacks at younger ages and greater in whites at ages 65 and over.[18]

Coronary Heart Disease

Chart 3-19
Prevalence of Angina Pectoris by Age and Sex, U.S., 1988-1994



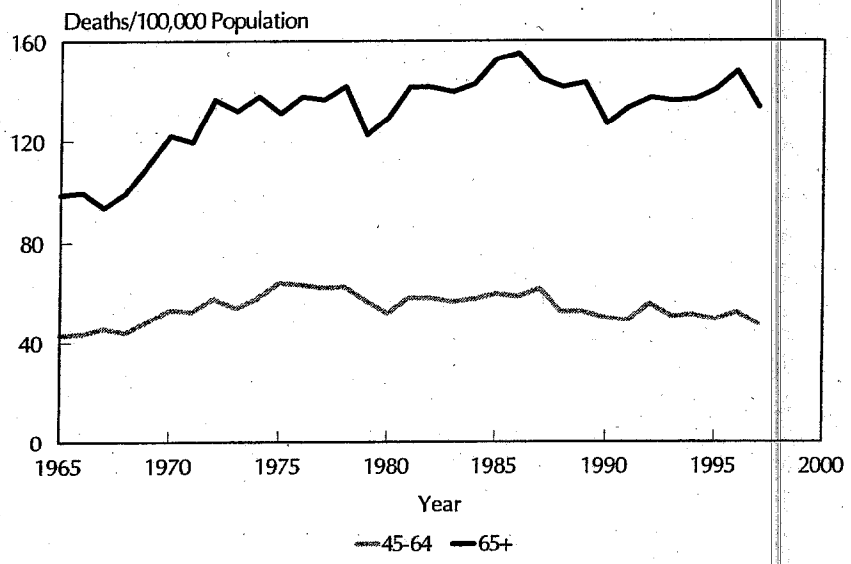
The prevalence of angina pectoris is greater in females than males between ages 25 and 74, after which it is greater in males.[18]

Chart 3-20
Prevalence of Angina Pectoris by Age and Race, U.S., 1988-1994

The prevalence of angina pectoris is greater in blacks than in whites older than age 25.[18]

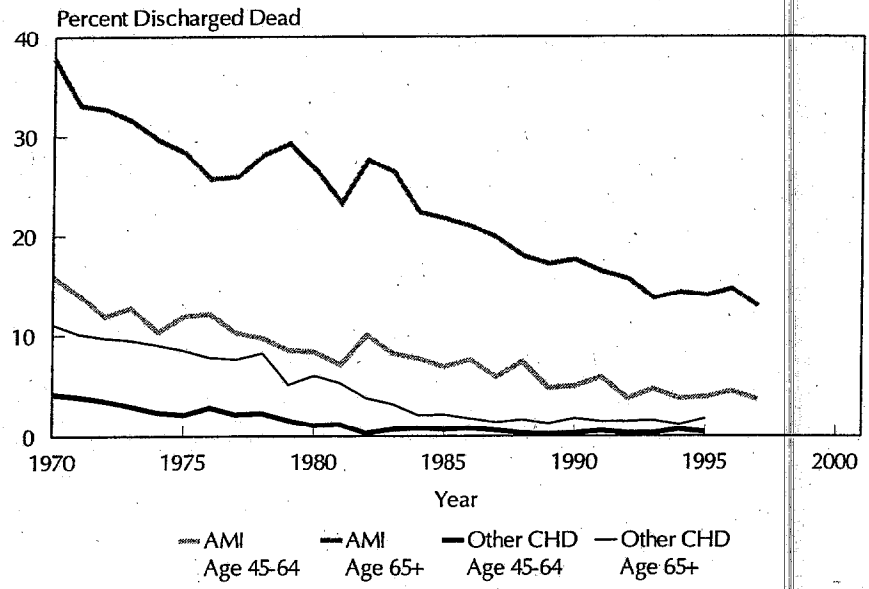
Coronary Heart Disease

Chart 3-21
Hospitalization Rates for Acute Myocardial Infarction, Age 45-64 and 65+, U.S., 1965-1997



The AMI hospitalization rate at age 45-64 increased between 1965 and the mid-1970s. It declined modestly between 1987 and 1997. For age 65+, the rate increased between 1965 and 1985 and then appears to have stabilized.[38]

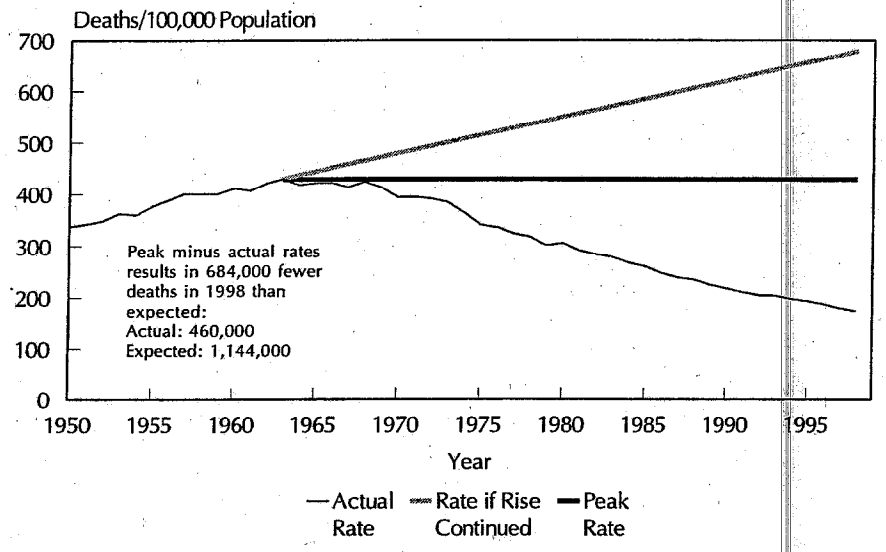
Chart 3-22
Hospital Case-Fatality Rates for Acute Myocardial Infarction and Other Coronary Heart Diseases, Age 45-64 and 65+, U.S., 1970-1997



Between 1970 and 1997, CHD hospital case-fatality rates declined substantially, especially for those age 65+.[38]

Coronary Heart Disease

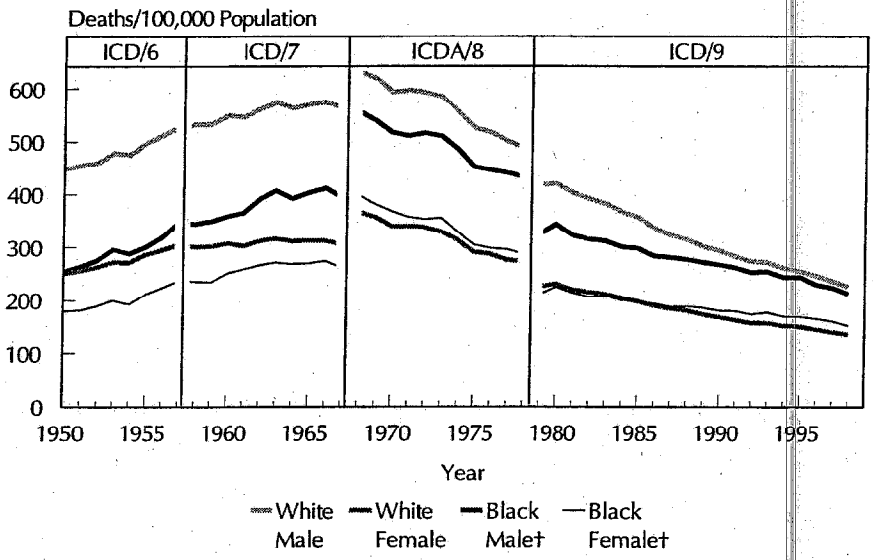
Chart 3-23
Age-Adjusted Death Rates* for Coronary Heart Disease, Actual and Expected, U.S., 1950-1998



* Age-adjusted to the 2000 standard.
Note: Comparability ratio applied to rates for 1968-1978.

CHD accounted for 460,000 deaths in 1998. It would have accounted for 1,144,000 if the rate had remained at its 1963 peak.[8, 15, 22, 29]

Chart 3-24
Age-Adjusted Death Rates* for Coronary Heart Disease by Race and Sex, U.S., 1950-1998

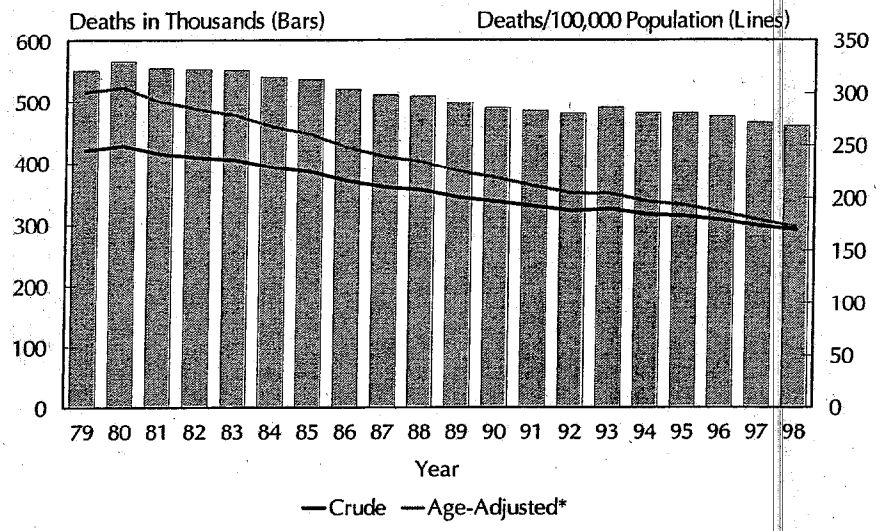


* Age-adjusted to the 2000 standard.
†Nonwhite from 1950 to 1967.

CHD death rates initially increased and then decreased for each race-sex group between 1950 and 1998. The white-black gap for males has narrowed due to a steeper decline in mortality in white males.[15, 22, 29]

Coronary Heart Disease

Chart 3-25
Deaths and Death Rates for Coronary Heart Disease, U.S., 1979-1998



* Age-adjusted to the 2000 standard.

Since 1980, the crude and age-adjusted death rates and the number of deaths for CHD have decreased almost every year.[15, 22, 29]

Chart 3-26
Average Annual Percent Change in Age-Adjusted Death Rates* for Coronary Heart Disease by Race and Sex, U.S., 1963-1998

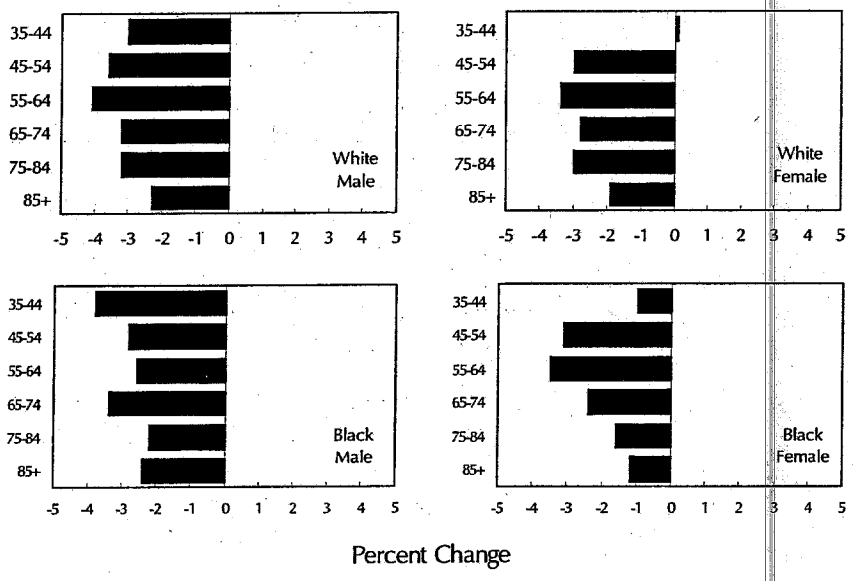
Period	Total Pop.	White Male	White Female	Black Male	Black Female
1963-1967	-0.7	-0.2	-0.6	-0.1	-0.6
1968-1978	-2.9	-2.6	-3.1	-2.5	-3.3
1979-1990	-3.1	-3.4	-2.8	-2.1	-1.7
1990-1995	-2.3	-2.7	-2.2	-1.9	-1.4
1995-1998	-3.6	-3.9	-3.3	-4.2	-3.4

* Age-adjusted to the 2000 standard.

In the 1980s and early 1990s, white males and females experienced steeper declines in CHD mortality than black males and females. However, between 1995 and 1998, the declines were greater for black males than for white males, but fairly similar for black and white females.[15, 22, 29]

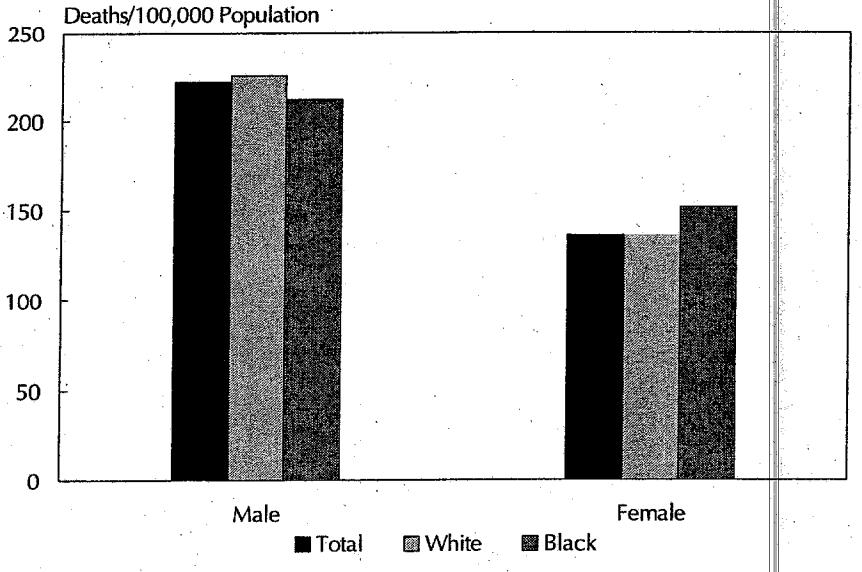
Coronary Heart Disease

Chart 3-27
Average Annual Percent Change in Death Rates for Coronary Heart Disease by Age, Race, and Sex, U.S., 1990-1998



Between 1990 and 1998, the average annual percent declines in CHD mortality after age 55 tended to decrease with age for white males, white females, and black females.[15, 22, 29]

Chart 3-28
Age-Adjusted Death Rates* for Coronary Heart Disease by Race and Sex, U.S., 1998

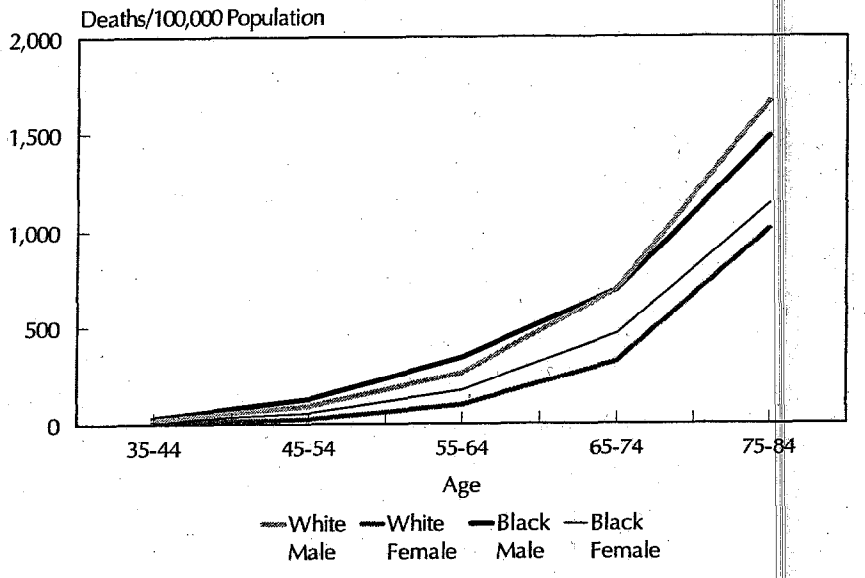


* Age-adjusted to the 2000 standard.

CHD mortality is slightly higher in white males than in black males, slightly higher in black females than in white females, and considerably higher in males than in females.[29]

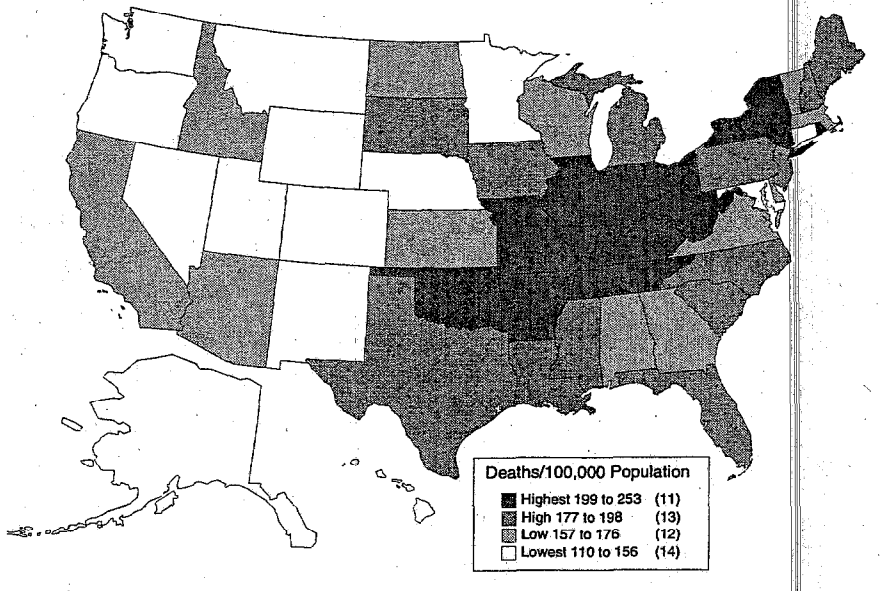
Coronary Heart Disease

Chart 3-29
Death Rates for Coronary Heart Disease by Age, Race, and Sex, U.S., 1998



In 1998, CHD mortality was higher in black females than in white females between age 35 and 84 and was higher in black males than in white males between age 35 and 64. Death rates were higher in males than in females.[29]

Chart 3-30
Age-Adjusted Death Rates* for Coronary Heart Disease by State, U.S., 1995-1997

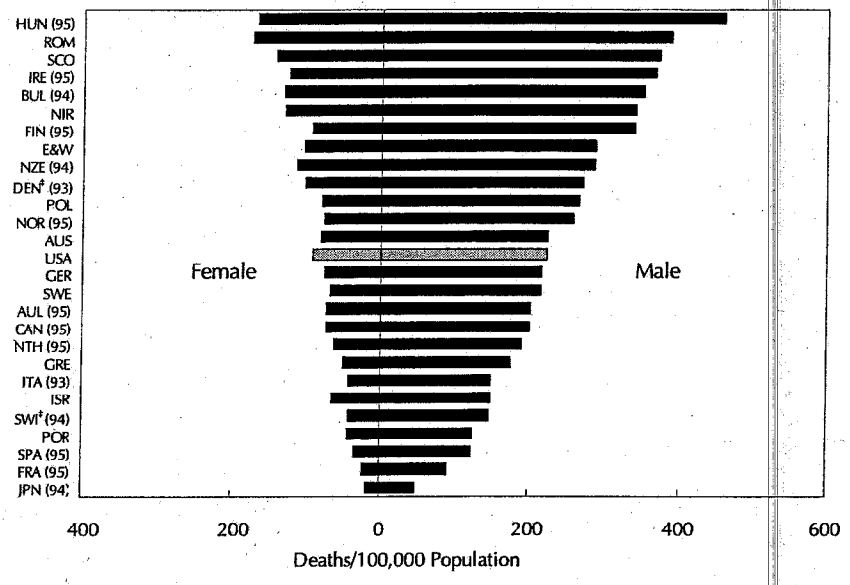


High CHD death rates are in a narrow band of states from New York through Appalachia to Oklahoma. Many western mountain states have low rates.[15]

* Age-adjusted to the 2000 standard.

Coronary Heart Disease

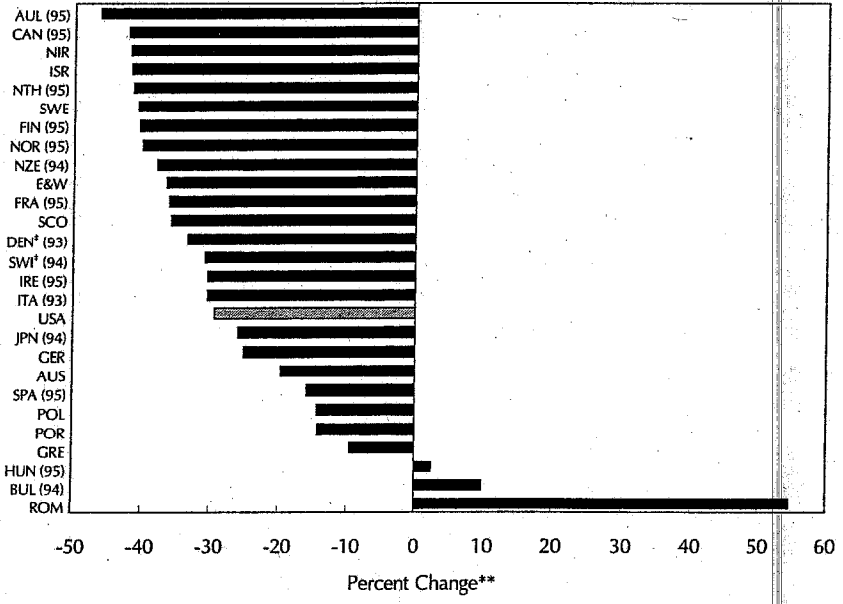
Chart 3-31
Age-Adjusted Death Rates* for Coronary Heart Disease by Country and Sex, Age 35-74, 1996†



Among 27 industrialized countries, the United States ranks 14th for CHD mortality in males and 11th in females. Not shown are rates for the Russian Federation: 736.9 in males and 254.6 in females.[11, 22]

* Age-adjusted to the European standard.
† Data for 1996 unless otherwise noted in parentheses.
‡ Eighth revision of the ICD.

Chart 3-32
Change in Age-Adjusted Death Rates* for Coronary Heart Disease in Males by Country, Age 35-74, 1986-1996†

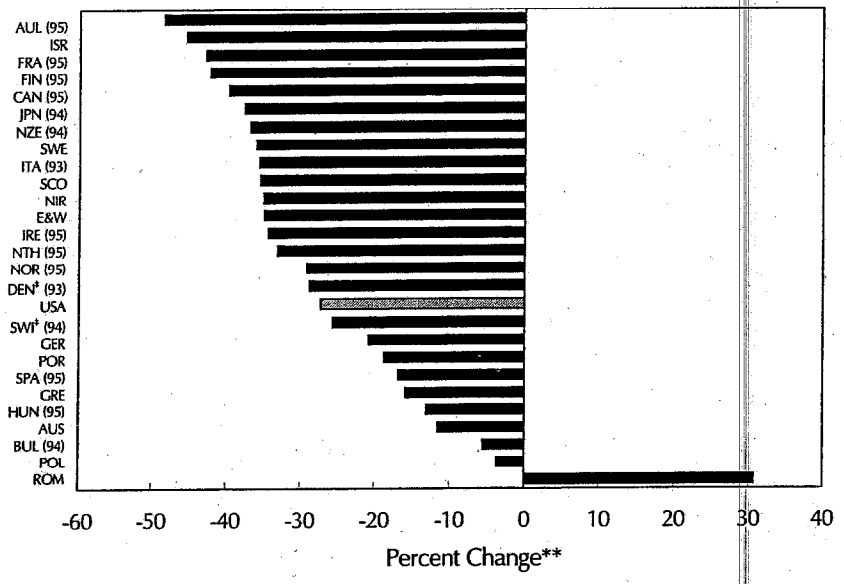


Between 1986 and 1996, 16 countries had a steeper decline in CHD mortality in males than the U.S.[11, 22]

* Age-adjusted to the European standard.
** Based on a log linear regression of the actual rates.
† Data for 1996 unless otherwise noted in parentheses.
‡ Eighth revision of the ICD.

Coronary Heart Disease/Congestive Heart Failure

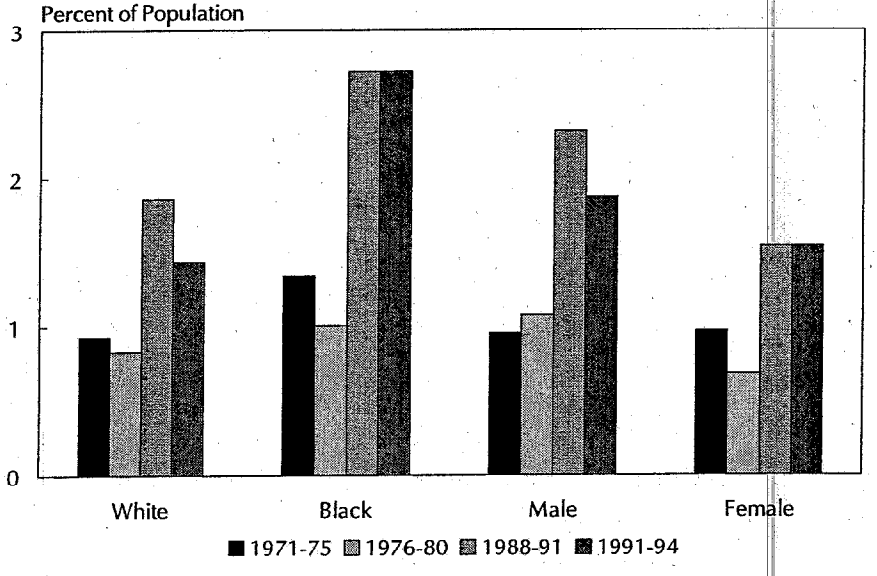
Chart 3-33
Change in Age-Adjusted Death Rates* for Coronary Heart Disease in Females by Country, Age 35-74, 1986-1996†



Between 1986 and 1996, 16 countries had a steeper decline in CHD mortality in females than the United States.[11, 22]

* Age-adjusted to the European standard.
** Based on a log linear regression of the actual rates.
† Data for 1996 unless otherwise noted in parentheses.
‡ Eighth revision of the ICD.

Chart 3-34
Prevalence* of Congestive Heart Failure by Race and Sex, Age 25-74, U.S., 1971-75 to 1991-94



Between 1976-80 and 1988-91, the prevalence of CHF increased substantially in each group: male and female, black and white, and remained at about those levels in 1991-94.[18]

* Age-adjusted to the 2000 standard.